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5-12-06
Date

John A. Pemberton

Dkt. No.: PSU-013

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

| | | |
|---|---|---|
| APPLICANT: Allcock et al. | ) | |
| SERIAL NO.: 10/779,483 | ) | **Art Unit**: 1711 |
| FOR: Synthesis of Polyphosphazenes with Sulfonimide Side Groups | ) | **Examiner**: Truong, Doc |

Commissioner for Patents
Alexandria, VA 22313

**DECLARATION UNDER 37 C.F.R. 1.132**

We, Daniel T. Welna and Richard M. Wood hereby declare that:

We, together with Harry R. Allcock, Catherine M. Ambler, Michael A. Hofmann and Andrew E. Maher are co-inventors of the subject matter of pending claims 43-46 of the above-identified application.

Harry R. Allcock, Catherine M. Ambler, Michael A. Hofmann and Andrew E. Maher, together with Elena Chalkova, Xiangyang Y. Zhou, and Serguei N. Lvov are co-authors of the Hofmann et al. reference entitled " Synthesis of Polyphosphazenes with Sulfonimide Side Groups". The aforesaid Hofmann et al. reference is cited by examiner against claims 43-46 of the above-identified application.

Elena Chalkova, Xiangyang Y. Zhou, and Serguei N. Lvov, in connection with synthesis of $[NP(OC_6H_4CH_3)(OC_6H_4SO_2NNaSO_2CF_3]$, worked under the direction of ourselves and our co-inventors and were not named as co-applicants for any of the claims of the above-identified application.

We have compared the Hofmann et al. reference to claims 43-46 of the above-identified application. Based on this comparison, for reasons discussed below, we declare that the teachings of Hofmann et al. directed to $[NP(OC_6H_4CH_3)(OC_6H_4SO_2NNaSO_2CF_3]$ as well as to the synthesis of $[NP(OC_6H_4CH_3)(OC_6H_4SO_2NNaSO_2CF_3]$ constitute the work of ourselves and our co-inventors as disclosed in the specification of the above-identified application and as

claimed in claims 43-46 of that application and are directly attributable to ourselves as well as to our applicants Harry R. Allcock, Catherine M. Ambler, Michael A. Hofmann and Andrew E. Maher.

Claims 43-46 of the above-identified application relate to a phenoxy sulfonimide functionalized polyphosphazene copolymer of the formula $[NP(ZR^2)_x(ZC_6H_4SO_2NR^1SO_2R_f)_{2-x}]_n$ where $R^1$ is any of Na, Li, H and K

Hofmann et al., at page 6491, shows a phenoxy sulfonimide functionalized polyphosphazene copolymer of the formula $[NP(OC_6H_4CH_3)(OC_6H_4SO_2NNaSO_2CF_3]$ as well as the synthesis thereof.

Comparison of the phenoxy sulfonimide functionalized polyphosphazene copolymer $[NP(OC_6H_4CH_3)(OC_6H_4SO_2NNaSO_2CF_3]$ of the Hofmann et al. reference with the claimed copolymer $[NP(ZR^2)_x(ZC_6H_4SO_2NR^1SO_2R_f)_{2-x}]_n$ shows that $[NP(OC_6H_4CH_3)(OC_6H_4SO_2NNaSO_2CF_3]$ is a species of the claimed copolymer $[NP(ZR^2)_x(ZC_6H_4SO_2NR^1SO_2R_f)_{2-x}]_n$ where $R^1$ is Na.

Based on comparison of the phenoxy sulfonimide functionalized polyphosphazene copolymers of claims 43-46 with the $NP(OC_6H_4CH_3)(OC_6H_4SO_2NNaSO_2CF_3]$ copolymer of the Hofmann et al. reference, we declare that the phosphazene copolymer $NP(OC_6H_4CH_3)(OC_6H_4SO_2NNaSO_2CF_3]$ of the Hofmann et al. reference constitutes solely the work of ourselves and of our co-applicants Harry R. Allcock, Catherine M. Ambler, Michael A. Hofmann and Andrew E. Maher. Also, the phenoxy sulfonimide functionalized $NP(OC_6H_4CH_3)(OC_6H_4SO_2NNaSO_2CF_3]$ copolymer of the Hofmann et al. reference and the synthesis thereof as disclosed in the Hofmann et al. reference are directly attributable to ourselves as well as to our applicants Harry R. Allcock, Catherine M. Ambler, Michael A. Hofmann and Andrew E. Maher.

We further declare that all statements made herein of our own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements are made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity or the application or any patent issuing thereon.

D. T. Welna
Daniel T. Welna

4/20/06
Date

Richard M. Wood

4/20/06
Date

# PHOSPHORUS–NITROGEN COMPOUNDS

*Cyclic, Linear, and High Polymeric Systems*

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ACADEMIC PRESS New York and London 1972

# Chapter 1

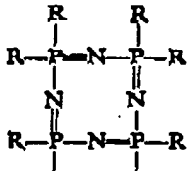
# INTRODUCTION, HISTORICAL BACKGROUND, AND NOMENCLATURE

## A. Introduction

This book reviews the chemistry of those ring and chain compounds which contain alternating phosphorus and nitrogen atoms in their skeleton. Three important groups of compounds fall into this category—the cyclo- and polyphosphazenes or phosphonitriles, the monophosphazenes or phosphinimines, and the phosphazanes.

The cyclo- or polyphosphazenes (phosphonitriles) are probably the best known and most intensively studied phosphorus–nitrogen derivatives. They are ring or chain compounds which have two substituents connected to each phosphorus atom, but no substituents on nitrogen, and they are characterized by a valence-unsaturated skeleton. Representative structures are the cyclic trimer (I), the cyclic tetramer (II), and the high polymer (III). The substituent,

I



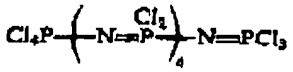
II

($n \approx 15{,}000$)

III

R, can be halogen, pseudohalogen, amino, azido, or a wide variety of organic groups such as alkoxy, aryloxy, alkylamino, arylamino, alkyl, or aryl. Mixed substitution is also possible. It is generally believed that the number of possible

homologues in each polymeric series is very large, with the range extending from cyclic trimers in a continuous series to very high molecular weight cyclic or linear polymers. Stable monomers of structure, $N{=}PR_2$, and cyclic dimers $(N{=}PR_2)_2$, have not been isolated in this series. Most phosphazene cyclic trimers and tetramers are white, crystalline solids which are soluble in organic liquids. The linear high polymers are elastomeric or thermoplastic. Nearly all these derivatives are stable to atmospheric oxygen and moisture. Phosphazene derivatives are also known in which short-chain segments are "end-capped" by the elements of an inorganic halide. Phosphorus pentachloride is an effective end-capping reagent, giving rise to compounds of the general type depicted in IV. These compounds are reminiscent of the monophosphazenes or phosphinimines to be introduced below. Many polymeric phosphazene derivatives are formed by the cross-linking of rings or chains.



IV

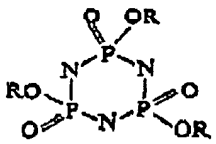
Monophosphazenes or phosphinimines have the structure V. They show

$$RN{=}PR_3$$

V

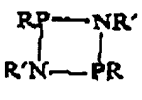
many fundamental similarities to the cyclic and polymeric phosphazenes mentioned above. They are particularly interesting from the viewpoint of their bonding structure, and much of the physical-inorganic work carried out on these compounds has an important bearing on the skeletal bonding found in cyclic and polymeric phosphazenes.

The *phosphazanes* constitute a diverse group of compounds which have the common characteristic of a formally saturated phosphorus–nitrogen skeletal bond. Several different types of phosphazane compounds are known, including the cyclotriphosphazanes or trimetaphosphimates depicted in VI and the cyclic



VI

VII



VIII

dimeric derivatives of the types shown in VII and VIII. It should be emphasized that other groups of phosphorus–nitrogen compounds are known, such as the phosphinic amides, $R_2(O)P{-}NR_2$, and aminophosphines, $R_2P{-}NH_2$. These latter compounds will not be reviewed in detail here.